

Side Impact Child Dummy Development

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Overview



- Side Child Dummy Concepts
- Evaluation Criteria
- Preliminary Results
- Dummy Development
- Evaluation Method
- Concluding Remarks



Side Child Dummy Concepts

NHTSA evaluating two dummies

- Q3s
- Hybrid III 3 year-old with modified head/neck (HIII-3Cs)



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Side Child Dummy Concepts

Q3s Dummy

- History/Development
- Key Features
 - new fiberglass skull
 - laterally biofidelic neck
 - improved shoulder
 - improved pelvis design
- OSRP and NHTSA



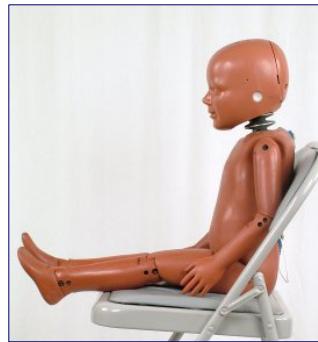
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Side Child Dummy Concepts

Hybrid III 3Cs

➤ History/Development



Evaluation Criteria

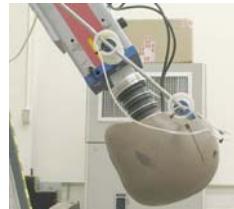
- Biofidelity Assessment
 - ISO 9790/Irwin, et al, Stapp 2002-2200016
- Durability
- Repeatability & Reproducibility

Evaluation Criteria

Biofidelity Assessment

➤ Component Tests

- Head Drop
- Neck Pendulum
- Shoulder Impact
- Thorax Impact
- Abdomen Impact
- Pelvis Impact



➤ ISO 9790 Sled Tests

- Heidelberg Wall
- Wayne State Wall

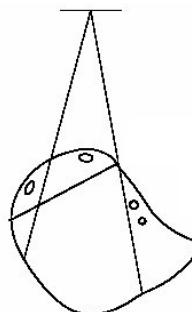


Evaluation Criteria

Head Drop

Frontal References:

- Irwin (Stapp 973317) - 376 mm drop
- van Ratingen (SAE 973316) - 130 mm drop

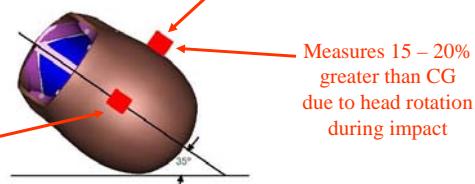


Evaluation Criteria

Head Drop

Lateral References:

- Irwin (Stapp 2002-22-0016)
 - 200 mm drop
 - Resultant acceleration measured at non-struck side
- van Ratingen (SAE 973316)
 - 130 mm drop
 - Resultant acceleration measured at CG



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Evaluation Criteria

Neck Pendulum Tests

Lateral Reference: Irwin (Stapp 2002-22-0016)

Frontal Reference: Irwin (Stapp 973317)

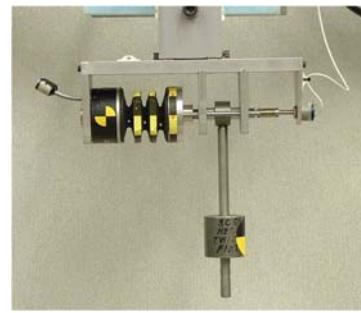


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Evaluation Criteria

Neck Pendulum Tests

Z-rotation (twist) Reference: Mertz, personal communication

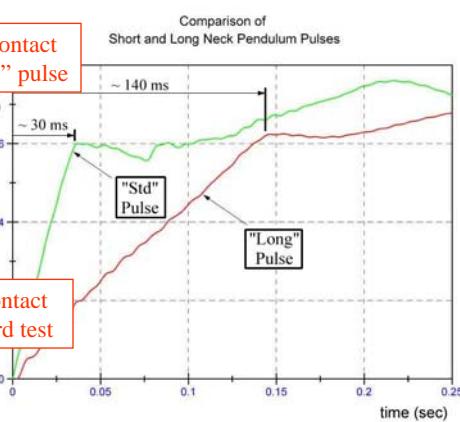
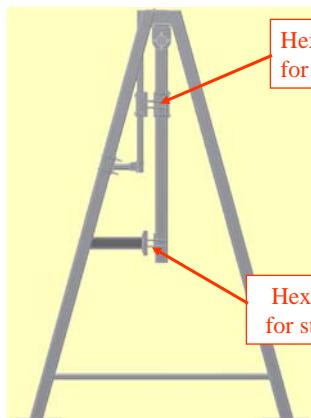


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Evaluation Criteria

Neck Biofidelity

Neck Pendulum Pulse Duration Considerations



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Evaluation Criteria

Neck Biofidelity

Head/Neck Sled Tests



Evaluation Criteria

Shoulder Impact

Reference #1: Irwin (Stapp 2002-22-0016)

Lateral impact to shoulder w/ 1.7 kg impactor at 4.5 m/s

Reference #2: Bolte (Stapp 2003-22-0003)

Lateral and oblique impact to shoulder
impactor mass and speed TBD



Evaluation Criteria

Thorax Impact

Reference: Irwin (Stapp 2002-22-0016)

Lateral impact to thorax w/ 1.7 kg impactor at 4.3 and 6.0 m/s



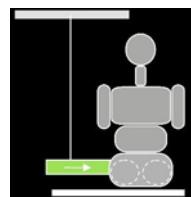
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Evaluation Criteria

Abdomen Impact

Reference: FTSS White Paper "Pendulum Response Corridors for 3 year-old Child Side Impact Dummies." Moss and Elhagediab. 2001

30° oblique impact to abdomen w/ 3.8 kg impactor at 4.8 and 6.8 m/s



Pelvis Impact

Reference: Irwin (Stapp 2002-22-0016)

Lateral impact to pelvis w/ 2.27 kg impactor at 4.5 and 10.0 m/s



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Evaluation Criteria

ISO Sled Tests

➤ Heidelberg



➤ Wayne State

Test conditions are TBD pending OSRP review



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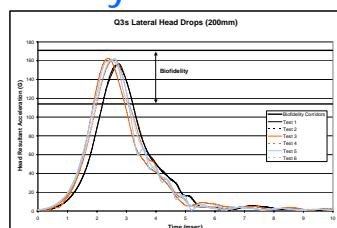
Evaluation Criteria

Durability

Tear in
pelvis flesh



Repeatability & Reproducibility



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Results



Preliminary Results

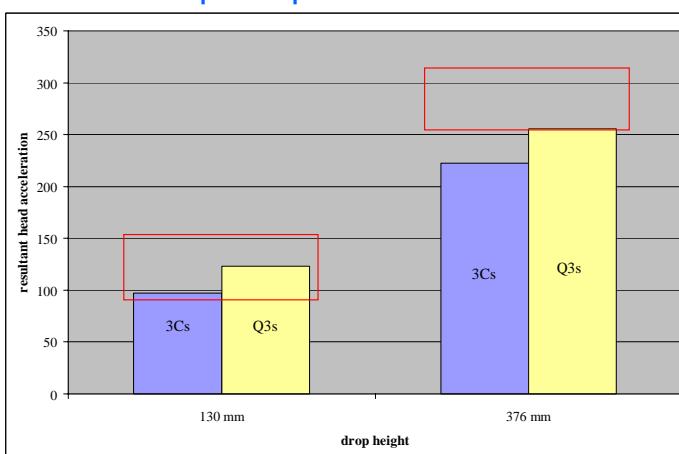


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Results



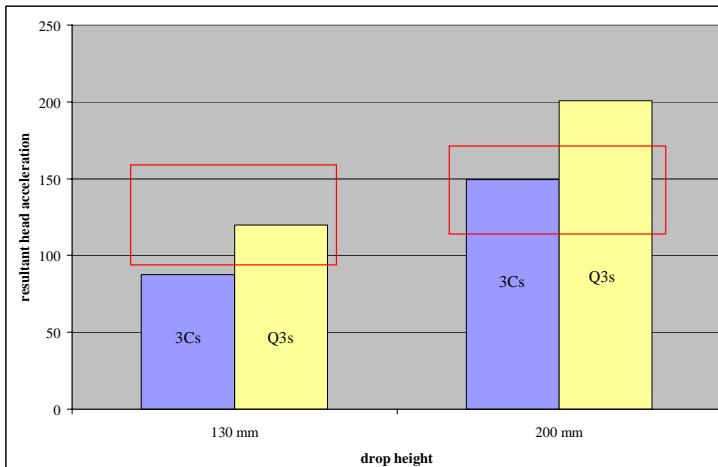
Frontal Head Drop Responses



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Results

Lateral Head Drop Responses

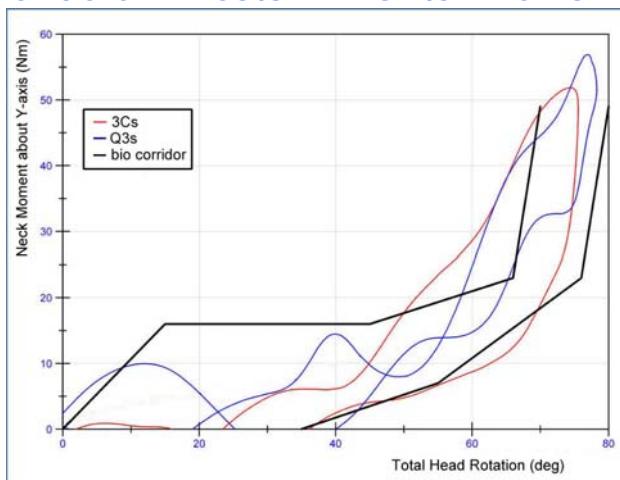


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Results

Neck Pendulum Tests – Frontal Flexion

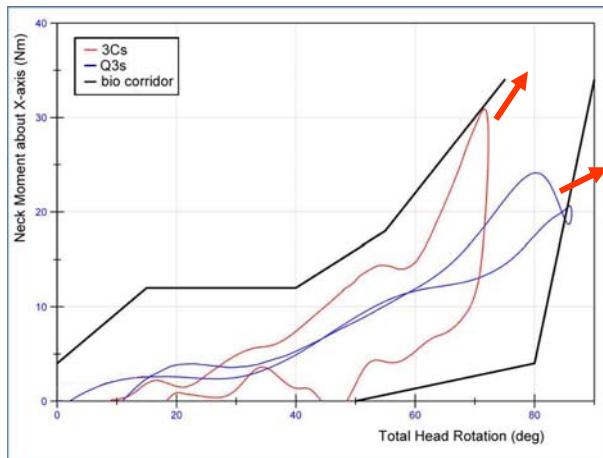


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Results

Neck Pendulum Tests – Lateral Flexion

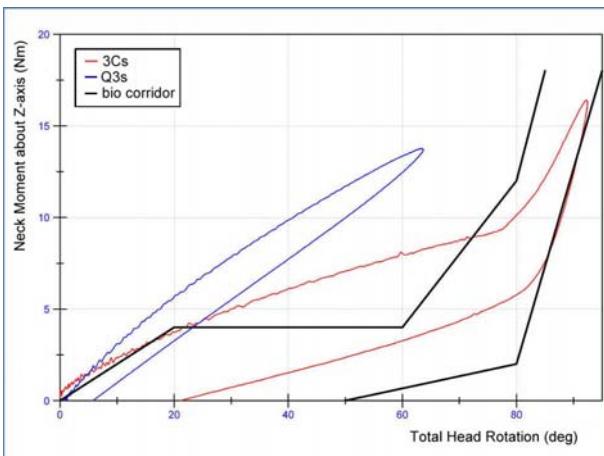


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Results

Neck Pendulum Tests – Twist



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Dummy Development

Q3s

- Modify arm flesh for improved interaction with thorax
- Modify head skin to meet frontal and lateral requirements



HIII-3Cs

- Develop pre-production neck
- Refine head drop performance

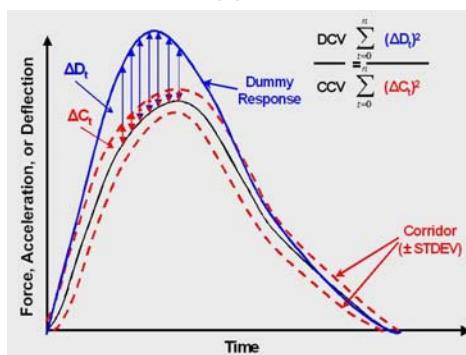


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Evaluation Method

NHTSA BioRank System

Reference: Rhule, et al (Stapp 2002-22-0024)



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Concluding Remarks

- Two dummy options
- Issues:
 - Head drop test
 - Significance of pulse on neck kinematics
 - Role of twist on overall neck performance
 - Q3s: new arm, head skin; 3Cs: pre-prod neck; head skin
 - Scaling of ISO sled conditions
- Collaboration between NHTSA and OSRP
- Test, test, and test some more



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Thank You



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